

SECTION 16123

OVERHEAD CONTACT SYSTEM INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A.** Work Included: This Section specifies the furnishing and installation of an overhead contact system for four storage tracks and a single test track as shown on the Contract Drawings and as specified herein. Furnishing and delivery of trolley wire shall be in accordance with Section 16140 - OVERHEAD CONTACT SYSTEM FITTING AND HARDWARE.
- B.** The work consists of the following:
1. Installation of new drop pipes, pendulum supports and terminations on the underside of the new structure.
 2. Installation of a new trolley wire system, including the messenger suspended test wires, as shown on the Contract Drawings.
 3. Installation of new feeder tap arrangements from disconnect switches to the new overhead system, as indicated on the Contract Drawings.
 4. Installation of new 1000A traction power disconnect switches and associated 600VDC distribution system providing power to the OCS. Work pertaining to the 600VDC distribution and switching systems is shown on the Contract Drawings and specified in Section 16126 - DC POWER CABLE AND DC POWER FEEDER DISCONNECT SWITCHES.

1.2 REFERENCES

- A.** Codes and Standards
1. Standards applicable to the overhead contact system installation that have been listed in other sections of this Specification also apply here.
 2. Comply with the most current provisions of the following, except as otherwise indicated. If there is a conflict between specifications and standards or between the various standards, then the most stringent requirement shall apply.
 - a. American National Standards Institute (ANSI)
 - b. National Electrical Safety Code (NESC)
 - c. Occupational Safety and Health Act of 1970 (OSHA)
 - d. National Electrical Manufacturers' Association (NEMA)

- e. Rules and regulations of the MBTA for performing work on MBTA property.

1.3 SUBMITTALS

A. The following information shall be submitted in accordance with Section 01300.

1. Submit assembly drawings in details of each assembly proposed. Each assembly shall be on its own drawing. The Contractor may, if space provides, without cluttering or confusing the assembly, include several variations of the same assembly on one drawing. All assemblies and variations shall be clear. A parts list shall be provided on the drawing in an easily readable matrix fashion that clearly identifies:

- a. the part;
- b. the quantity for each assembly;
- c. the number it refers to on the drawing; and
- d. where the part itself can be found to review for detail.

B. The Contractor shall submit to the Engineer, descriptions and sketches explaining proposed methods and procedures for new trolley wire and support system installation. These submittals shall include, but not be limited to, the following:

1. Sequential phases of the work
2. Equipment to be used
3. Procedure for temporarily supporting new wire, if required

C. The Contractor shall submit a detailed sequence of work at least one month in advance and updated as frequently as need be to keep one month in advance. The sequence shall show how many crews will be working, when, where and what equipment will be utilized, and define the area of work and the proposed limits. This will be reviewed by the Authority for reasonableness so that MBTA requirements can be evaluated and set up. An alternate plan for work shall be submitted for the event that the Contractor is restricted from the planned location of work.

1.4 QUALITY ASSURANCE

A. General: Examine the conditions under which the components of the overhead contact system are to be installed.

B. Notify the Engineer of conditions encountered or foreseen, which could

affect the installation of the catenary system.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A.** Items shall be furnished that are of the materials, design, sizes and ratings shown on the Contract Drawings and specified herein, and required by the installation specified in Sections 16121, 16122, 16123 and 16140 of this Specification and required by the installation specified in this Section.
- B.** In order to ensure compatibility with the existing overhead contact system, to provide continuity of hardware throughout the entire Authority overhead network, to provide interchangeability of hardware and to reduce required Authority inventory, certain specific components of the overhead system have been specified by manufacturer's part number or approved equal. For a cross-referenced list of Contract part numbers with approved manufacturer and manufacturer's part numbers, refer to the table included as Appendix B of Section 16140. Contractor shall verify that indicated components function properly as indicated on the Contract Drawings. Substitutions shall be per approval of the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION OF INSULATORS AND HARDWARE

A. General

1. Deadends shall be attached to structures prior to stringing operations to prevent overstress or damage.
2. All braces, brackets, etc. shall be attached, complete to receive the OCS hardware and devices to support the conductors in their final position.
3. Care should be exercised in joining individual hardware components to form complete assemblies.
4. Clamped and bolted connections shall be made as to prevent damage and distortion of the joined pieces.
5. Hardware pieces joined to provide flexibility of movement shall be installed to prevent excessive bonding or chafing of surfaces when movement does occur.
6. Insulators: Insulators shall be cleaned before installation. Only clean rags, free from abrasive material, shall be used for cleaning insulators. Wire brushes shall not be used for cleaning parts, metal or non-metal. After installation, insulator assemblies and hardware shall be clean, bright and free from nicks or blemishes.

B. Hardware:

1. Hardware shall be inspected for cleanliness and damage. Any item that does not fit, creates damage to the galvanizing during installation, or is found defective shall be rejected.
2. All hardware shall be installed as shown on the Contract Drawings using tools and methods as recommended by the manufacturer. Bolts and nuts shall be properly tightened in accordance with the manufacturer's recommendations. All bolts, excluding foundation bolts, shall be of sufficient length to protrude at least two full threads, but not more than 1/2 inch beyond the nut or locknut. Bolt ends shall not be cut off. Where locknuts are not used, lockwashers shall be provided.
3. All cotter pins should have each leg-opened 45° after installation.

C. Connectors:

1. Current-carrying connectors shall be as shown on the Contract Drawings and shall be installed in accordance with the manufacturer's recommendations. Connectors for copper or bronze wire shall be copper or bronze or a combination of copper and bronze.
2. Bolts in bolt-type connectors shall be lubricated as recommended by the manufacturer and torqued to the manufacturer's recommendation using a calibrated torque wrench.
3. The connectors shall be factory-loaded with a corrosion inhibitor, which is made for the specific purpose.
4. Wire surfaces which are in contact with conducting surfaces of the connector shall be thoroughly wire brushed and shall have an inhibitor applied. Where connectors are not factory-loaded, the same inhibitor shall be applied in the field to the connector.
5. Corrosion inhibitors shall be stable over a wide temperature range, able to adhere to cold metal surfaces, water-repellent, weather resistant, and inert to copper, aluminum, zinc, tin, cadmium, steel, and neoprene rubber. Grit-bearing inhibitors shall be used except for flat lugs, sliding surfaces or where the connector manufacturer recommends omission. Grit shall be compatible with the connector and wire metal. Inhibitor for copper and bronze shall be T&B "Kopr Shield", Fargo "Fargolene", Penn-Union "Cual-Aid", Burndy "Penetrox A", or approved equivalent.

3.2 INSTALLATION OF TROLLEY WIRES

A. Trolley Wire Reels

1. For each length of wire installed, a record shall be kept of the reel number from which the wire was taken. Partly used reels shall be recorded as such.

2. The wire may be ordered with several lengths of wires on one reel to satisfy several runs. As each length is cut and removed, the length remaining on the reel shall be recomputed and properly recorded both on the reel and on substantiating documentation.
3. Care must be taken with reels so as not to prejudice the stringing operation. Damaged reels shall be set aside for repair or replacement before use.

B. Precautions in Handling Trolley Wires

1. The wire shall be handled in such a manner that it shall not be scratched, cut, or nicked with tools or clamps.
2. The wire shall not lie upon or be dragged across, sharp or rough surfaces.
3. Wire shall not be annealed.
4. Sharp bends shall not be put in the wires.
5. The wire shall not be marred with temporary wire or hook hangers.
6. Only approved parallel jaw clamps shall be used in tensioning all wire. The grooves of the clamps must be free from burrs, fins or roughness and the ends of the grooves must be flared (bell-shaped).
7. Vertical kinks in the wire shall be removed. A leather or copper-faced hammer shall be used, beating against a smooth flat surface such as a hardwood block.
8. Lateral kinks in the wire shall be removed if they affect the fit of any parts.

3.3 TROLLEY WIRE STRINGING

- A.** The method of erecting the wires shall be submitted to and approved by the Engineer prior to erecting the wire.
- B.** Care shall be taken to prevent kinks in the wires. The Authority reserves the right to reject any wire in its entirety if it is judged that any kink will prejudice current-collection performance.
- C.** Splices shall not be permitted at any location except as shown on the Contract Drawings, or unless otherwise approved by the Engineer.
- D.** Any damage to the wires shall be reported to the Authority. Remedial action shall be indicated and recorded.
- E.** Stringing of the wires shall start from the location shown on the Contract Drawings. The wires shall be pulled from the reel and lifted into position.

Sufficient tension must be maintained in each wire during stringing to ensure that under no circumstances do the wires touch the ground or track between support points.

- F.** When the termination location is reached, each wire shall be tensioned above the specified final tension by 15%, but not to exceed 5,000 pounds. This tension shall be held for approximately two hours and then slackened to the specified erection tension. Tension measuring device shall be installed at both ends of the wire during installation and tensioning.
- G.** Erection tensions shall be in accordance with tables furnished for the purpose, based on the span and temperature of the wire, as shown on the Contract Drawings.
- H.** Wire temperatures shall be measured by digital thermometer. The probe of the thermometer shall be in intimate contact with the wire when read.
- I.** A record of temperature and tension measured at both ends of the tension lengths shall be submitted to the Engineer.

3.4 EQUIPMENT AND HARDWARE INSTALLATION

- A.** The Contractor shall submit to the Engineer, in writing, a request with the proposed schedule including dates, times, and the methods to be used. Coordination will be required with the Authority to agree on a date and time for each site and the action of work required by each party.
- B.** As far as practical, bolts shall be installed in the various clips so that the nuts are on the same side giving uniform appearance. On curves, the nuts shall be placed to the inside of the curve to provide the best clearance to the pantograph.
- C.** As the contact wire clips are fastened to the wire, any twist in the trolley wire shall be removed by working from one splice to another.
- D.** New hangers, where required for proper support of the trolley wire as shown on the Contract Drawings, shall be prefabricated or field cut, based on Contractor's field measurements with tolerance to permit field adjustments necessary for trolley wire heights to be maintained. Along track positioning of each hanger shall be plus or minus 3 inches of intended position. Hangers shall be furnished and installed in accordance with MBTA Specification P-160, included as Appendix A of this Section, as modified herein, and on the Contract Drawings.

3.5 SUPPORT, REGISTRATION AND FEEDER ASSEMBLIES

A. Pendulum Support Assemblies

- 1. New pendulum assemblies shall be manufactured in accordance to the dimensions, materials and working loads as shown on the Contract Drawings.

2. New pendulum assemblies shall be installed to support and register the trolley wires at the positions and heights as shown on the Contract Drawings.

B. Feeder Assemblies

1. The Contractor shall install new feeder tap connections as shown on the Contract Drawings.

3.6 OTHER SUPPORT SYSTEMS AND FITTINGS

A. Installation of Jumper Assemblies

1. All jumpers shall be installed at locations denoted on the Contract Drawings.
2. Before fitting of the jumper clamps, the conductor shall be wire brushed for good electrical connection.
3. The Contractor shall install the jumpers in accordance with the normal direction of travel.

B. Installation of Trolley Wire Deadends

1. The Contractor shall install the trolley wire deadends in accordance with the Contract Drawings.
2. The Contractor shall coordinate this activity with the installation of the structural braces, guys, drop pipes and clamps before installation.

3.7 FINAL ADJUSTMENTS

- A.** After support registration, and termination assemblies have been installed, a final check of the construction and adjustment to final position shall be made.
- B.** Height and lateral position of wire shall be checked, adjusted where necessary.
- C.** The wire heights given in the Contract Drawings are the heights after final tensioning and proper registration has been installed.
- D.** The stagger of the trolley wire shown in the Contract Drawings is relative to the centerline of the bus path. The stagger is measured in inches to left or right of this centerline in the direction of travel.
- E.** Tolerances shall be as follows:
 1. Stagger of trolley wire plus or minus one inch.
 2. Height trolley wire shall be plus or minus 1/2 inch.

3.8 TROLLEY WIRE MEASUREMENTS AT SUPPORTS AND MIDSPAN

- A.** The following measurements shall be made and recorded with the wire in its final position:
1. Wire height above the plane of the roadway at each support point.
 2. Wire temperature and air temperature including time of day.
 3. Trolley wire stagger relative to centerline of the bus path at each registration point and at midspan.
- B.** A complete set of the final height and stagger dimensions as accepted shall be submitted to the Engineer by the Contractor before the final inspection and shall be incorporated into the final as-built drawings.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Furnishing, installing, testing and commissioning all elements of the overhead contact system, including all drop pipes, support, registration and termination assemblies, aerial conductors, feeder taps, disconnect switches dc stinger system, and dc distribution cables, including FRE conduit and supports, as shown in the Contract Drawings and specified herein, (pay item 1630.210) will be measured on a Lump Sum Basis, complete in place with all required accessories and incidentals, and shall include all work and materials for a complete and functional installation.

4.2 PAYMENT

The overhead contact system will be paid for at the contract Lump Sum price as specified above, complete and in place, and shall include all work and materials for a complete installation.

| <u>ITEM NO.</u> | <u>UNIT</u> | <u>DESCRIPTION</u> |
|------------------------|--------------------|---------------------------|
| 1630.210 | | DC Electrification |
| Lump Sum | | |

END OF SECTION